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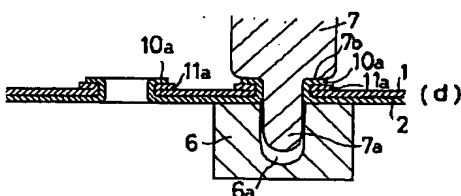
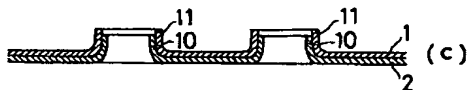
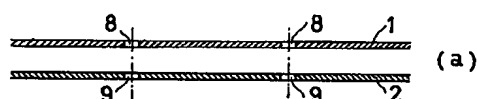
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(54) 【発明の名称】 板状金属材の接合構造

(57) 【要約】

【課題】板状金属材を厚さ方向に重ね合わせて接合する場合に、厚さ方向の引張力はもとより厚さ方向と直角な方向の剪断力に対しても高い接合強度を有する、板状金属材の重ね合わせ接合構造を提供する。

【解決手段】下孔 8、9 を設けた塑性変形可能な複数の金属材 1、2 を、各下孔が一致するように厚さ方向に重ね合わせる。最外側に位置する一方の金属材 2 に、他の金属材 1 を厚さ方向に貫通するかしめ用筒部 10 を前記下孔 8、9 の位置において金属材 2 の素材を立ち上げることによって形成したのち、このかしめ用筒部 10 の端部周縁部を、最外側に位置する他方の金属材 1 を包み込むように拡張方向へ屈曲しかつかしめる。端部かしめ部 10 a と最外側に位置する一方の金属材 2 との間に他の金属材 1 が挟着される。下孔 8、9 は設けなくても良い。



【特許請求の範囲】

【請求項 1】 下孔を設けた塑性変形可能な複数の金属材料を、前記各下孔が一致するように厚さ方向に重ね合わせるとともに、最外側に位置する一方の金属材料に、他の金属材料を厚さ方向に貫通するかしめ用筒部を前記下孔の位置において金属材料の素材を立ち上げることによって形成したのち、このかしめ用筒部の端部周縁部を、最外側に位置する他方の金属材料を包み込むように拡張方向へ屈曲しかつかしめることによって、端部かしめ部と前記最外側に位置する一方の金属材料との間に他の金属材料を挟着してなることを特徴とする板状金属材料の重ね合わせ接合構造。

【請求項 2】 塑性変形可能な複数の金属材料を、下孔を設けることなく厚さ方向に重ね合わせるとともに、最外側に位置する一方の金属材料に、他の金属材料を厚さ方向に貫通するかしめ用筒部を金属材料の素材を突き破りかつ立ち上げることによって形成したのち、このかしめ用筒部の端部周縁部を、最外側に位置する他方の金属材料を包み込むように拡張方向へ屈曲しかつかしめることによって、端部かしめ部と前記最外側に位置する一方の金属材料との間に他の金属材料を挟着してなることを特徴とする板状金属材料の重ね合わせ接合構造。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】 この発明は、例えば自動車のボディー等を形成するために、金属板どうしあるいはアルミニウム製押出材の板状部どうしを重ね合わせて接合するのに好適に用いられる、板状金属材料の重ね合わせ接合構造に関する。

【0002】

【従来の技術】 複数枚の板状金属材料を厚さ方向に重ね合わせて確実に接合する方法としては溶接による方法が代表的であるが、この方法は、接合に手間がかかるうえに、溶接の際に生じる熱によって部材が熱影響を受けるため、歪みが生じたり接合部での強度が低下する等の難点があった。

【0003】 そこで、従来から、溶接によることなく板状金属材料を厚さ方向に重ね合わせて接合するものとして、リベットを用いたり、図 3 に示すように一方の金属板（21）の接合箇所凹部（21a）を形成し、かつ他方の金属板（22）の接合箇所に前記凹部に適合する凸部（22a）を形成して、それらを嵌め合わせて接合することが行われている。

【0004】

【発明が解決しようとする課題】 しかしながら、前者のリベットによる接合では、厚さ方向（リベットの軸方向）の引張り力に対しては接合強度は高いが、リベット孔はリベットがスムーズに挿通できるようリベット径よりやや大きめに設けられているため、リベットとリベット孔との間でガタが生じ、厚さ方向と直角な方向の剪断

力に対しては金属材料どうしの接合強度に劣るという欠点があった。

【0005】 また、後者の図 3 に示す方法の場合、両金属板の凹凸部相互の食い込み量を多くすることが容易でないために、厚さ方向の引張り力が加わると簡単に抜け外れてしまうという欠点があった。

【0006】 この発明は、このような技術的背景に鑑みてなされたものであって、板状金属材料を厚さ方向に重ね合わせて接合する場合に、厚さ方向の引張り力はもとより厚さ方向と直角な方向の剪断力に対しても高い接合強度を有する、板状金属材料の重ね合わせ接合構造を提供することを課題とする。

【0007】

【課題を解決するための手段】 上記課題は、下孔を設けた塑性変形可能な複数の金属材料を、前記各下孔が一致するように厚さ方向に重ね合わせるとともに、最外側に位置する一方の金属材料に、他の金属材料を厚さ方向に貫通するかしめ用筒部を前記下孔の位置において金属材料の素材を立ち上げることによって形成したのち、このかしめ用筒部の端部周縁部を、最外側に位置する他方の金属材料を包み込むように拡張方向へ屈曲しかつかしめることによって、端部かしめ部と前記最外側に位置する一方の金属材料との間に他の金属材料を挟着してなることを特徴とする板状金属材料の重ね合わせ接合構造によって解決される。

【0008】 この構造によれば、かしめ用筒部の端部周縁部を、最外側に位置する他方の金属材料を包み込むように拡張方向へ屈曲しかつかしめることによって、最外側に位置する一方の金属材料とかしめ用筒部の端部かしめ部との間に他の金属材料を挟着するので、厚さ方向の引張り力のもとより厚さ方向と直角な方向の剪断力に対しても、ガタつきや剥離がなく、高い接合強度が得られる。

【0009】 かしめ用筒部の形成は例えばバーリング加工によれば良いし、かしめ用筒部の端部周縁部を、最外側に位置する他方の金属材料を包み込むように拡張方向へ屈曲しかつかしめるのは、プレスによって行えば良い。

【0010】 しかも、かしめ用筒部の形成を、各金属材料に設けた下孔が一致するように各金属材料を重ね合わせた状態で、前記下孔の位置において行うから、下孔の形成によりかしめ用筒部の形成が容易になるとともに、かしめ用筒部の形成位置が予め決定されているから、接合位置の選択作業が楽になる。なお、下孔は重ね合わせ前にそれぞれの金属材料に対して予め形成しておいても良いし、重ね合わせた状態で一括的に行っても良い。

【0011】 また、上記課題は、塑性変形可能な複数の金属材料を、下孔を設けることなく厚さ方向に重ね合わせるとともに、最外側に位置する一方の金属材料に、他の金属材料を厚さ方向に貫通するかしめ用筒部を金属材料の素材を突き破りかつ立ち上げることによって形成したのち、このかしめ用筒部の端部周縁部を、最外側に位置する他方の金属材料を包み込むように拡張方向へ屈曲しかつかし

めることによって、端部かしめ部と前記最外側に位置する一方の金属材との間に他の金属材を挟着してなることを特徴とする板状金属材の重ね合わせ接合構造によっても解決される。

【0012】この構造によれば、前記と同様に、かしめ用筒部の端部周縁部を、最外側に位置する他方の金属材を包み込むように拡張方向へ屈曲しかつかしめることによって、最外側に位置する一方の金属材とかしめ用筒部の端部かしめ部との間に他の金属材を挟着するので、厚さ方向の引張力はもとより厚さ方向と直角な方向の剪断力に対しても、ガタつきや剥離がなく、高い接合強度が得られる。

【0013】しかも、かしめ用筒部の形成を、各金属材に下孔を設けることなく重ね合わせた状態で行うから、下孔を形成する手間が省けるとともに、かしめ用筒部の形成位置つまり接合位置を任意に移動したり増やしたりすることができる。

【0014】なお、かしめ用筒部の形成はやはりバーリング加工等によれば良いし、かしめ用筒部の端部周縁部を、最外側に位置する他方の金属材を包み込むように拡張方向へ屈曲しかつかしめるのは、プレスによって行えば良い。

【0015】

【発明の実施の形態】次にこの発明の一実施形態を、2枚のアルミニウム製薄板を接合する場合を例にとって説明する。

【0016】図1は第1実施形態を示すものである。図1(a)において、(1)(2)は長さ方向の一端部を互いに重ね合わせて接合される上下2枚のアルミニウム製薄板であり、これらアルミニウム製薄板(1)(2)の接合箇所には、円形の小孔からなる同大の下孔(8)(9)が穿設されている。この下孔(8)(9)は、薄板(1)(2)の重ね合わせ前に、それぞれの薄板に対して形成されたものであるが、重ね合わせたのちに同時に下孔を形成しても良い。

【0017】そして、図1(b)に示すように、上下の下孔(8)(9)がほぼ一致するように、上側薄板(1)と下側薄板(2)とを重ね合わせる。

【0018】次に、図1(c)に示すように、下側薄板(2)の下方から上方へバーリング成形することによって、下孔(8)(9)の周縁部が上方に立ち上げられる。これにより、下側薄板(2)の素材からなる円筒状のかしめ用筒部(10)が、上側薄板(1)の厚さを超えて貫通した状態に、かつ外側に上側薄板(1)の素材からなる筒部(11)が存在した状態に形成される。

【0019】次に、図1(d)に示すように、重ね合わせた両薄板(1)(2)に対して、かしめ用筒部(10)を屈曲変形しかつかしめるためのプレス加工を行う。即ち、上面中央に凹部(6a)を有するダイス(6)を、前記凹部(6a)がかしめ用筒部(10)の

下方に位置するように両薄板(1)(2)の下側に配置する一方、下面中央に円柱状の凸部(7a)を有するポンチ(7)をかしめ用筒部(10)の上方に配置する。なお、ポンチ(7)の凸部(7a)の外径は、ダイス(6)の凹部(6a)の内径よりもわずかに小さく設定されている。そして、前記ポンチ(7)を下降方向に前進させて、その凸部(7a)を前記かしめ用筒部(10)の孔内に上方から挿入するとともに、凸部(7a)の先端を前記ダイス(6)の凹部(6a)に進入案内させつつポンチ(7)をさらに下降させる。なお、ポンチ(7)の凸部(7a)の外径は、かしめ用筒部(10)の内径よりもわずかに大きく設定されており、該凸部(7a)をかしめ用筒部(10)の孔内に挿入したときに、かしめ用筒部(10)を拡張変形させてかしめ用筒部(10)と上側薄板(1)の筒部(11)との密着力を増大するように構成されている。

【0020】ポンチ(7)の下降により、上側薄板(1)の筒部(11)及び下側薄板(2)のかしめ用筒部(10)の端部周縁部に、ポンチ凸部(7a)の基端部に続く肩部(7b)の湾曲形状に沿って圧力が加えられ、この圧力によってかしめ用筒部(10)の端部周縁部は、上側薄板(1)の筒部(11)を包み込むように径方向外側に屈曲したのち、やがては筒部(11)を巻き込んで密に圧接される。

【0021】こうして、前記かしめ用筒部(10)の端部周縁部はかしめられて環状の端部かしめ部(10a)が形成され、該端部かしめ部(10a)と下側薄板(2)との間に上側薄板(1)の筒部屈曲部(11a)が全周にわたって挟着固定される。従って、薄板を厚さ方向に引き剥がす方向の引張力、及び厚さ方向と直交する方向(薄板の平面方向)の剪断力のいずれに対しても、ガタを生じないのはもとより十分な接合強度を保持したものとなる。

【0022】なお、この実施形態では、両薄板(1)(2)に設けられる各下孔(8)(9)は同径なものとしたが、異径なものとしてもよい。例えば、下側薄板(2)の下孔(9)の直径を、上側薄板(1)の下孔(8)の直径より適度に小さく形成すると、かしめ部における上下薄板(1)(2)の平面方向のずれを少なくすることができる。

【0023】また、上下薄板を重ね合わせた状態で同時にバーリングを行うから、各薄板の下孔(8)(9)の位置が若干ずれてもこのずれを許容することができ、確実な接合が可能となる。

【0024】図2は、この発明のさらに他の実施形態を示すものである。

【0025】この実施形態では、アルミニウム製の上下薄板(1)(2)を下孔をあけることなく重ね合わせて接合を行ったものである。

【0026】まず、図2(a)に示すように、両薄板

(1) (2) を互いの面が密着する態様で重ね合わせた後、図 2 (b) に示すように、両薄板 (1) (2) の上方に受けダイス (1 2) を下方に穿孔用ポンチ (1 3) を配置するとともに、穿孔用ポンチ (1 3) を下方から上方へ前進させて薄板 (1) (2) を突き破り穿孔すると同時に、その孔の周縁部をダイス (1 2) の角部 (1 2 a) の湾曲形状に沿って圧力を加えて上方に起こして立ち上げる。これにより、下側薄板 (2) の素材からなる円筒状のかしめ用筒部 (1 5) が、上側薄板 (1) の厚さを超えて貫通した状態に、かつ外側に上側薄板 (1) の素材からなる筒部 (1 6) が存在した状態に形成される。

【0027】そして、図 2 (c) に示すように、重ね合わされた両薄板 (1) (2) に対して、かしめ用筒部 (1 5) を屈曲変形しかつかしめるためのプレス加工を行う。プレス加工は、図 1 に示した受けダイス (6) と加圧用ポンチ (7) を用いて、図 1 に示したのと同様の手順で行う。即ち、前記ポンチ (7) を下降方向に前進させて、その凸部 (7 a) を前記かしめ用筒部 (1 5) の孔内に上方から挿入するとともに、凸部 (7 a) の先端を前記ダイス (6) の凹部 (6 a) に進入案内させつつポンチ (7) をさらに下降させる。なお、ポンチ (7) の凸部 (7 a) の外径は、かしめ用筒部 (1 5) の内径よりもわずかに大きく設定されており、該凸部 (7 a) をかしめ用筒部 (1 5) の孔内に挿入したときに、かしめ用筒部 (1 5) を拡張変形させてかしめ用筒部 (1 5) と上側薄板 (1) の筒部 (1 6) との密着力を増大するように構成されている。

【0028】ポンチ (7) の下降により、上側薄板 (1) の筒部 (1 6) 及び下側薄板 (2) のかしめ用筒部 (1 5) の端部周縁部に、ポンチ凸部 (7 a) の基端部に続く肩部 (7 b) の湾曲形状に沿って圧力が加えられ、この圧力によってかしめ用筒部 (1 5) の端部周縁部は、上側薄板 (1) の筒部 (1 6) を包み込むように径方向外側に屈曲したのち、やがては筒部 (1 6) を巻き込んで密に圧接される。

【0029】こうして、前記かしめ用筒部 (1 5) の端部周縁部はかしめられて環状の端部かしめ部 (1 5 a) が形成され、該端部かしめ部 (1 5 a) と下側薄板 (2) との間に上側薄板 (1) の筒部屈曲部 (1 6 a) が全周にわたって挟着固定される。従って、薄板を厚さ方向に引き剥がす方向の引張力、及び厚さ方向と直交する方向 (薄板の平面方向) の剪断力のいずれに対しても、ガタを生じないのはもとより十分な接合強度を保持したものとなる。

【0030】このように、この実施形態に係る接合構造

によれば、下孔が不要となるので、下孔形成工程が不要となり工程数を減らすことができると共に、接合位置を任意に移動したり増やしたりすることができる。

【0031】以上に本発明の実施形態を説明したが、本発明はこれら実施形態に限定されるものではない。例えばアルミニウム製の薄板を接合するものとしたが、アルミニウム以外の他の金属材の接合にも適用できるし、また一部が板状になった金属材をその板状部分において重ね合わせ接合する場合に適用しても良い。また、金属材の重ね合わせ枚数は 2 枚に限定されることなく、3 枚以上を重ねて接合しても良い。

【0032】

【発明の効果】請求項 1 及び請求項 2 に係る接合構造によれば、金属材の厚さ方向の引張力、厚さ方向と直交する方向の剪断力に対して、ガタが生じることを防止できるのはもとより、金属材相互の剥離やずれを防止でき、接合強度の極めて高い接合構造となし得る。また、その接合構造は簡易なものであるため、簡単な作業で金属板を接合することができる。

【0033】さらに、接合にリベットのような接合用部材を別途必要とすることなく、金属材自体の素材を利用しているから、低コストで済み経済的である。

【0034】加えて、請求項 1 に係る接合構造では、かしめ用筒部の形成を、各金属材に設けた下孔が一致するように各金属材を重ね合わせた状態で、前記下孔の位置において行うから、下孔の形成によってかしめ用筒部の形成を容易に行い得るとともに、かしめ用筒部の形成位置が予め決定されているから、かしめ用筒部の形成位置つまり接合位置の選択作業も容易になる効果がある。

【0035】一方、請求項 2 に係る接合構造によれば、かしめ用筒部の形成を、各金属材を下孔を設けることなく重ね合わせた状態で行うから、下孔を形成する手間が省けるとともに、接合位置を任意に移動したり増やしたりすることができる効果がある。

【図面の簡単な説明】

【図 1】この発明の一実施形態に係る接合構造を得るための工程図である。

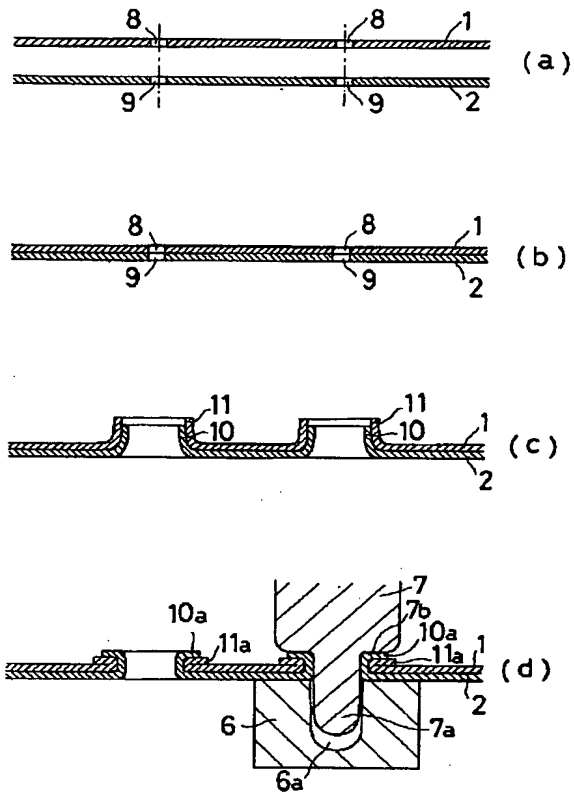
【図 2】この発明にの他の実施形態に係る接合構造を得るための工程図である。

【図 3】従来の接合構造を示した断面図である。

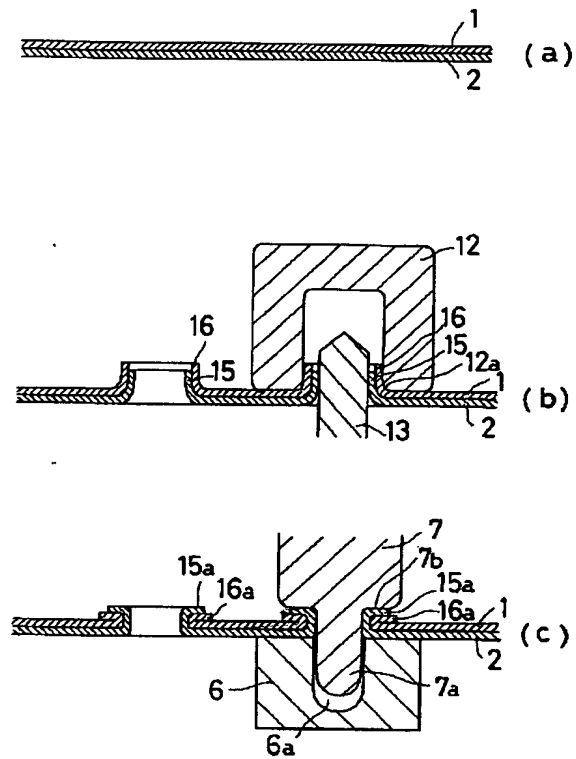
【符号の説明】

- 1・・・上側薄板 (金属材)
- 2・・・下側薄板 (金属材)
- 10、15・・・かしめ用筒部
- 10a、15a・・・端部かしめ部
- 8、9・・・下孔

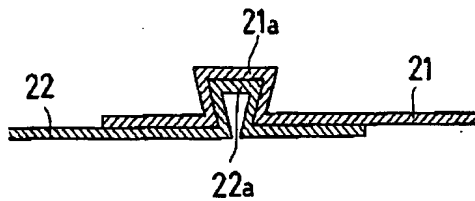
【図 1】



【図 2】



【図 3】



フロントページの続き

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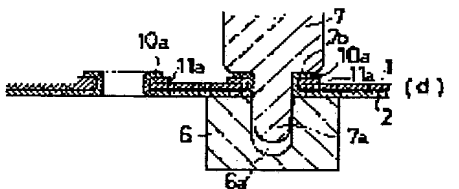
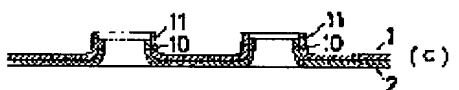
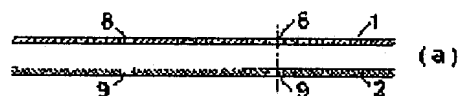
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(54) JOINING STRUCTURE OF SHEET SHAPE METALLIC MATERIAL

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a lap joining structure of a sheet shape metallic material having high joining strength even to a shearing stress in the right-angled direction to the thickness direction, let alone a tensile stress in the width direction in placing the sheet shape metallic material upon another in the thickness direction.

SOLUTION: The plural metallic materials 1 and 2 on which prepared holes 8 and 9 have been provided and which are plastically deformable, are placed one upon another in the width direction so that each prepared hole coincides. After forming cylindrical parts 10 for calking, which pierce through another metallic material 1 in the thickness direction on the metallic material 2 on the one side, positioning outermostly by erecting the base stock of the metallic material 2 in the positions of the prepared holes 8 and 9, the peripheral parts of the tip parts of these cylindrical parts 10 for calking, are bent in the diameter expansion direction so that another metallic material 1 positioning outermostly is wrapped, and are calked. Another metallic material 1 is held and fixed between the calked parts 10a of the tip parts and the metallic material 2 on the one side, positioning outermostly. The prepared holes 8 and 9 need not be provided.



LEGAL STATUS

[Date of request for examination]

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CLAIMS

[Claim(s)]

[Claim 1] While piling up two or more metal material which prepared the hole the bottom and which can be deformed plastically in the thickness direction so that each aforementioned **** may be in agreement After locating while in the maximum outside and forming the cylinder part for caulking which penetrates other metal material in the thickness direction to metal material by starting the material of metal material in the position of a hole under the above, By making only incurvation attach in the diameter expansion direction so that the metal material of another side located in the maximum outside in the edge periphery section of this cylinder part for caulking may be wrapped in Superposition junction structure of tabular metal material where other metal material is fastened between metal material, and while it is located in the edge caulking section and the aforementioned maximum outside is characterized by the bird clapper.

[Claim 2] While piling up two or more metal material which can be deformed plastically in the thickness direction, without preparing a hole the bottom After forming by locating while in the maximum outside, breaking through the material of metal material and starting the cylinder part for caulking which penetrates other metal material in the thickness direction to metal material, By making only incurvation attach in the diameter expansion direction so that the metal material of another side located in the maximum outside in the edge periphery section of this cylinder part for caulking may be wrapped in Superposition junction structure of tabular metal material where other metal material is fastened between metal material, and while it is located in the edge caulking section and the aforementioned maximum outside is characterized by the bird clapper.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the superposition junction structure of the tabular metal material used suitable to pile up metal plates or the plate-like parts of the extruded material made from aluminum, and join, in order to form the body of an automobile etc.

[0002]

[Description of the Prior Art] Although the method by welding was typical as a method of piling up the tabular metal material of two or more sheets in the thickness direction, and joining certainly, distortion arose and this method had the difficulty of the intensity in a joint falling, in order that a member might receive a thermal effect in junction with the heat which time and effort produces in this top in the case of welding.

[0003] Then, using a rivet as what piles up tabular metal material in the thickness direction, and is joined, without being based on welding, or forming a crevice (21a) in the junction part of a metal plate (21) from the former, as while shows drawing 3 , and forming in the junction part of the metal plate (22) of another side the heights (22a) which suit the aforementioned crevice, inserting them in and joining is performed.

[0004]

[Problem(s) to be Solved by the Invention] however -- although a bonding strength is [as opposed to / the pull strength of the thickness direction (shaft orientations of a rivet) / by junction by the former rivet] high -- a rivet -- since the hole is prepared a little more greatly than the diameter of a rivet so that a rivet can insert in smoothly -- a rivet and a rivet -- backlash arose between holes and there was a fault that it was inferior to the bonding strength of metal material to the shearing force of the thickness direction and a right-angled direction

[0005] Moreover, since it was not easy to make [many] the amount of interlocking between the concavo-convex sections of both metal plates in the case of the method shown in latter drawing 3 , when the pull strength of the thickness direction was added, there was a fault of escaping simply and separating.

[0006] This invention is made in view of such a technical background, and when you pile up tabular metal material in the thickness direction and you join, let it be a technical problem for the tensile force of the thickness direction to offer the superposition junction structure of the tabular metal material which has a high bonding strength also to the shearing force of the thickness direction and a right-angled direction from the first.

[0007]

[Means for Solving the Problem] While the above-mentioned technical problem piles up two or more metal material which prepared the hole the bottom and which can be deformed plastically in the thickness direction so that each aforementioned **** may be in agreement After locating while in the maximum outside and forming the cylinder part for caulking which penetrates other metal material in the thickness direction to metal material by starting the material of metal material in the position of a hole under the above, By making only incurvation attach in the diameter expansion direction so that the metal material of another side located in the maximum

outside in the edge periphery section of this cylinder part for caulking may be wrapped in The superposition junction structure of tabular metal material where other metal material is fastened between metal material, and while it is located in the edge caulking section and the aforementioned maximum outside is characterized by the bird clapper is solved.

[0008] By making only incurvation attach in the diameter expansion direction so that the metal material of another side located in the maximum outside in the edge periphery section of the cylinder part for caulking may be wrapped in according to this structure While is located in the maximum outside, since other metal material is fastened between metal material and the edge caulking section of the cylinder part for caulking, the tensile force of the thickness direction does not have backlash and ablation to the shearing force of the thickness direction and a right-angled direction from the first, and a high bonding strength is obtained.

[0009] Formation of the cylinder part for caulking should just be based on burring, and making only incurvation attach in the diameter expansion direction so that the metal material of another side located in the maximum outside in the edge periphery section of the cylinder part for caulking may be wrapped in should just perform it with a press.

[0010] And since the formation position of the cylinder part for caulking is beforehand determined while formation of the cylinder part for caulking becomes easy by formation of a hole the bottom, since it carries out in the position of a hole under the above where each metal material is piled up so that a hole may be in agreement the bottom which prepared formation of the cylinder part for caulking in each metal material, the selection work of a junction position becomes easy. In addition, the bottom, a hole may be beforehand formed to each metal material before superposition, and may be performed in package in the state where it piled up.

[0011] Moreover, while the above-mentioned technical problem piles up two or more metal material which can be deformed plastically in the thickness direction, without preparing a hole the bottom After forming by locating while in the maximum outside, breaking through the material of metal material and starting the cylinder part for caulking which penetrates other metal material in the thickness direction to metal material, By making only incurvation attach in the diameter expansion direction so that the metal material of another side located in the maximum outside in the edge periphery section of this cylinder part for caulking may be wrapped in The superposition junction structure of tabular metal material where other metal material is fastened between metal material, and while it is located in the edge caulking section and the aforementioned maximum outside is characterized by the bird clapper is also solved.

[0012] By making only incurvation attach in the diameter expansion direction so that the metal material of another side located in the maximum outside in the edge periphery section of the cylinder part for caulking may be wrapped in like the above according to this structure While is located in the maximum outside, since other metal material is fastened between metal material and the edge caulking section of the cylinder part for caulking, the tensile force of the thickness direction does not have backlash and ablation to the shearing force of the thickness direction and a right-angled direction from the first, and a high bonding strength is obtained.

[0013] And since formation of the cylinder part for caulking is performed in the state where it piled up without preparing a hole in each metal material the bottom, while being able to save the time and effort which forms a hole the bottom, it can move arbitrarily, the formation position, i.e., the junction position, of the cylinder part for caulking, or can increase.

[0014] In addition, formation of the cylinder part for caulking should just be too based on burring etc., and making only incurvation attach in the diameter expansion direction so that the metal material of another side located in the maximum outside in the edge periphery section of the cylinder part for caulking may be wrapped in should just perform it with a press.

[0015]

[Embodiments of the Invention] Next, 1 operation gestalt of this invention is explained taking the case of the case where the sheet metal made from aluminum of two sheets is joined.

[0016] Drawing 1 shows the 1st operation gestalt. In drawing 1 (a), (1) and (2) are sheet metal made from aluminum of two upper and lower sides which piles up the end section of the length direction mutually and is joined, and a hole (8) and (9) are drilled in the junction part of the sheet metal made from these aluminum (1), and (2) under Doshisha University which consists of a

circular stoma. This the bottom, although a hole (8) and (9) are formed to each sheet metal before the superposition of sheet metal (1) and (2), after piling up, they may form a hole the bottom simultaneously.

[0017] and it is shown in drawing 1 (b) -- as -- the upper and lower sides -- lower -- a hole (8) and (9) -- about -- top sheet metal (1) and bottom sheet metal (2) are piled up so that I may do one

[0018] Next, as shown in drawing 1 (c), the periphery section of a hole (8) and (9) is started up the bottom by carrying out burring fabrication upwards from the lower part of bottom sheet metal (2). the state where the cylinder part for caulking (10) of the shape of a cylinder which consists of a material of bottom sheet metal (2) penetrated by this exceeding the thickness of top sheet metal (1) -- and it is formed in the state where the cylinder part (11) which consists of a material of top sheet metal (1) existed outside

[0019] Next, as shown in drawing 1 (d), press working of sheet metal for only flexion deformity making the cylinder part for caulking (10) attach is performed to both piled-up sheet metal (1) and (2). That is, while arranging the dice (6) which has a crevice (6a) in the center of the upper surface to the both sheet metal (1) and (2) down side so that the aforementioned crevice (6a) may be located under the cylinder part for caulking (10), the punch (7) which has pillar-like heights (7a) in the center of an inferior surface of tongue is arranged above the cylinder part for caulking (10). In addition, the outer diameter of the heights (7a) of punch (7) is slightly set up small rather than the bore of the crevice (6a) of a dice (6). and the aforementioned punch (7) is moved forward in the downward direction -- making -- the heights (7a) -- the hole of the aforementioned cylinder part for caulking (10) -- punch (7) is dropped further, making the crevice (6a) of the aforementioned dice (6) carry out penetration guidance of the nose of cam of heights (7a), while inserting from the upper part inside In addition, the outer diameter of the heights (7a) of punch (7) it sets up greatly slightly rather than the bore of the cylinder part for caulking (10) -- having -- **** -- these heights (7a) -- the hole of the cylinder part for caulking (10), when it inserts inside It is constituted so that diameter expansion deformation of the cylinder part for caulking (10) may be carried out and the adhesion force of the cylinder part for caulking (10) and the cylinder part (11) of top sheet metal (1) may be increased.

[0020] bottom sheet metal [the cylinder part (11) of top sheet metal (1), and] (2) go away by descent of punch (7) -- making -- business -- in the edge periphery section of a cylinder part (10) A pressure is applied in accordance with the curve configuration of the shoulder (7b) following the end face section of punch heights (7a). with this pressure the edge periphery section of the cylinder part for caulking (10) After being crooked on the direction outside of a path so that the cylinder part (11) of top sheet metal (1) may be wrapped in, ***** (11) is involved in soon and a pressure welding is carried out densely.

[0021] In this way, the edge caulking section (10a) caulking **** annular in the edge periphery section of the aforementioned cylinder part for caulking (10) is formed, and fastening fixation of the cylinder part flexion (11a) of top sheet metal (1) is carried out at a perimeter over this edge caulking section (10a) and bottom sheet metal (2). Therefore, it becomes what held sufficient bonding strength from the first not to produce backlash also to any of the tensile force of the direction which tears off sheet metal in the thickness direction, and the shearing force of the thickness direction and the direction (the direction of a flat surface of sheet metal) which intersects perpendicularly.

[0022] each **** (8) prepared in both sheet metal (1) and (2) with this operation gestalt and (9) -- said -- although considered as the **** thing, it is good also as a different diameter thing [in addition,] for example, bottom sheet metal (2) -- lower -- the diameter of a hole (9) -- top sheet metal (1) -- lower -- if it forms small moderately from the diameter of a hole (8), a gap of the direction of a flat surface of the vertical sheet metal (1) in the caulking section and (2) can be lessened

[0023] Moreover, since burring is simultaneously performed where vertical sheet metal is piled up, even if the position of a hole (8) and (9) shifts a little under each sheet metal, this gap can be permitted, and positive junction is attained.

[0024] Drawing 2 shows the operation form of further others of this invention.

[0025] With this operation gestalt, the vertical sheet metal made from aluminum (1) and (2) are piled up without opening a hole the bottom, and it joins.

[0026] First, as shown in drawing 2 (a), after piling up both sheet metal (1) and (2) in the mode which a mutual field sticks, as shown in drawing 2 (b) By receiving above both sheet metal (1) and (2), while arranging the punch for punching (13) caudad, a dice (12) A pressure is applied in accordance with the curve configuration of the corner (12a) of a dice (12), and the periphery section of the hole is started up and started at the same time it advances the punch for punching (13) upwards from a lower part and breaks through and punches sheet metal (1) and (2). the state where the cylinder part for caulking (15) of the shape of a cylinder which consists of a material of bottom sheet metal (2) penetrated by this exceeding the thickness of top sheet metal (1) -- and it is formed in the state where the cylinder part (16) which consists of a material of top sheet metal (1) existed outside

[0027] And as shown in drawing 2 (c), press working of sheet metal for only flexion deformity making the cylinder part for caulking (15) attach is performed to both piled-up sheet metal (1) and (2). The same procedure as having received and having been shown [which was shown in drawing 1] in drawing 1 using a dice (6) and the punch for pressurization (7) performs press working of sheet metal. namely, the aforementioned punch (7) is moved forward in the downward direction -- making -- the heights (7a) -- the hole of the aforementioned cylinder part for caulking (15) -- punch (7) is dropped further, making the crevice (6a) of the aforementioned dice (6) carry out penetration guidance of the nose of cam of heights (7a), while inserting from the upper part inside In addition, the outer diameter of the heights (7a) of punch (7) it sets up greatly slightly rather than the bore of the cylinder part for caulking (15) -- having -- **** -- these heights (7a) -- the hole of the cylinder part for caulking (15), when it inserts inside It is constituted so that diameter expansion deformation of the cylinder part for caulking (15) may be carried out and the adhesion force of the cylinder part for caulking (15) and the cylinder part (16) of top sheet metal (1) may be increased.

[0028] bottom sheet metal [the cylinder part (16) of top sheet metal (1), and] (2) go away by descent of punch (7) -- making -- business -- in the edge periphery section of a cylinder part (15) A pressure is applied in accordance with the curve configuration of the shoulder (7b) following the end face section of punch heights (7a). with this pressure the edge periphery section of the cylinder part for caulking (15) After being crooked on the direction outside of a path so that the cylinder part (16) of top sheet metal (1) may be wrapped in, ***** (16) is involved in soon and a pressure welding is carried out densely.

[0029] In this way, the edge caulking section (15a) caulking **** annular in the edge periphery section of the aforementioned cylinder part for caulking (15) is formed, and fastening fixation of the cylinder part flection (16a) of top sheet metal (1) is carried out at a perimeter over this edge caulking section (15a) and bottom sheet metal (2). Therefore, it becomes what held sufficient bonding strength from the first not to produce backlash also to any of the tensile force of the direction which tears off sheet metal in the thickness direction, and the shearing force of the thickness direction and the direction (the direction of a flat surface of sheet metal) which intersects perpendicularly.

[0030] thus -- according to the junction structure concerning this operation gestalt -- lower -- since a hole becomes unnecessary -- lower -- a hole -- a formation process becoming unnecessary and reducing the number of processes can move a junction position arbitrarily with ****, or it can increase

[0031] Although the operation gestalt of this invention was explained above, this invention is not limited to these operation gestalt. For example, although the sheet metal made from aluminum shall be joined, it is applicable also to junction of other metal material other than aluminum, and when a part piles up the metal material which became a tabular in a part for the plate-like part and joins, you may apply. Moreover, the superposition number of sheets of metal material is not limited to two sheets, and may join three or more sheets in piles.

[0032]

[Effect of the Invention] According to the junction structure concerning a claim 1 and a claim 2, from the first, that it can prevent that backlash arises to the tensile force of the thickness

direction of metal material and the shearing force of the thickness direction and the direction which intersects perpendicularly can prevent the ablation and the gap between metal material, and it can make with the very high junction structure of a bonding strength. Moreover, since the junction structure is simple, it can do ** which joins a metal plate by easy work.

[0033] Furthermore, since the material of the metal material itself is used without needing a member for junction like a rivet for junction separately, it is a low cost, and ends and is economical.

[0034] In addition, with the junction structure concerning a claim 1, where each metal material is piled up so that a hole may be in agreement the bottom which prepared formation of the cylinder part for caulking in each metal material Since the formation position of the cylinder part for caulking is beforehand determined while being able to form the cylinder part for caulking easily by formation of a hole the bottom, since it carries out in the position of a hole under the above, it is effective in it becoming easy selection work [the formation position of the cylinder part for caulking, i.e., a junction position,].

[0035] On the other hand, since it carries out in the state where it piled up without preparing [formation of the cylinder part for caulking] a hole for each metal material the bottom, while being able to save the time and effort which forms a hole the bottom according to the junction structure concerning a claim 2, there is an effect which can move a junction position arbitrarily or can be increased.

[Translation done.]